



# TEST REPORT

According to ANSI/IES LM-80-15  
For

## Shenzhen Runlite Technology Co.,Ltd

Building A15, Tantou the 4th Industrial Estate, SongGang Town, BaoAn District, ShenZhen,  
China

**#Model:P28351-W27SK2K3FR4R7-LX00**

<b>Report Type:</b> 9000 Hours Test Report	<b>Product Type:</b> LED Package
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<b>Report Number:</b> RSZ190703505-10-9000	
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<b>Reviewed By:</b> Bill Xiong / EE Engineer	
<b>Test Facility:</b> Test facility was located at No.69,Pulongcun ,Puxinhu Industrial Area, Tangxia , Dongguan, Guangdong, China.	
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<b>Accreditation:</b>	The IAS Accreditation Number TL-460.

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## 1 - General Information

### 1.1 Description of LED Light Sources

#### Sample Size:

75 PCS test samples were in good condition and received on 2019-07-03. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75.

#Manufacturer:	Shenzhen Runlite Technology Co.,Ltd
#Part Number:	P28351-W27SK2K3FR4R7-LX00
#Part Type:	LED Package
#Drive Level:	DC 20mA
#Nominal CCT:	2700K
#Power:	1.44 W
#Average Current Density per LED die:	105.44mA/mm <sup>2</sup>
#Average Power Density per LED die:	1.898W/mm <sup>2</sup>
#CRI:	80
#Die Spacing:	0.18mm

#### Sampling Method:

LED samples for IESNA LM-80 testing consist of units built from a minimum of three manufacturing lots with each manufacturing lot built from different wafer lots built on non-consecutive days.

These manufacturing lots are picked to represent a wide parametric distribution.

#### #Family products covered by this report:

According to *ENERGY STAR® Requirements for the Use of LM-80 Data*, the following products can be covered by this report base on the information and declaration provided by manufacturer. The information of these models shows that the covered products meet all section 4 requirements of *ENERGY STAR® Requirements for the Use of LM-80 Data* (September 28, 2017)

This report covers the following models:

Model type	Model Name	CCT(K)	Series	Parallel	Power density PCB (W/mm <sup>2</sup> )	Current density per LED die (mA/mm <sup>2</sup> )	Current per die (mA)	Distance between of dies(mm)	Current (mA)
Master model	P28351-W27SK2K3FR4R7-LX00	2700	4	1	0.147	105.44	20	0.18	20
	*2835*-W*****-****-AA	≥2200	4	1	0.147	105.44	20	0.18	20
	*2835*-W*****-****-AB	≥2200	3	1	0.11	105.44	20	0.22	20
	*2835*-W*****-****-AC	≥2200	2	2	0.147	105.44	20	0.18	40

The family models and tested model could meet all the requirements listed as below:

- The testes model has the greatest number of LED dies. and,
- Minimum die edge of die edge spacing of the family models is greater than or equal to that of the tested LED package; and,
- the family models' electrical power density (i.e. W/mm<sup>2</sup> of PCB or substrate total area, or equivalent calculation) less than or equal to the tested LED package; and,
- average current density per LED die (i.e. mA/mm<sup>2</sup> of epitaxial structures) less than or equal to the tested LED package; and,
- identical materials used (note: this does not constrain phosphor quantity and/or dimensional adjustments); and,
- identical construction processes used;

**Note:** AA/AB/AC is not the part of our products code rules ,we only use it to distinguish the parallel and series mode of the chip.

## 1.2 Standards and Reference Documentations

- ANSI/IES LM-80-15: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- CIE 127:2007: Measurement of LEDs
- ENERGY STAR® Requirements for the Use of LM-80 Data (This standard was not accredited by IAS)

## 1.3 Testing Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
0.5m integrating sphere	EVERFINE	AIS-2	G185304TA1381172	2019-10-22	2020-10-21
LED Test Source	EVERFINE	LTS-300	P185616CD1371113	2020-07-23	2021-07-22
High Accuracy Array Spectroradiometer	EVERFINE	HAAS-2000	P600674CM1381123	2019-10-22	2020-10-21
Standard Light Source	EVERFINE	D062	1011093	2019-11-19	2020-11-18
Multilayer aging machine	BACL	B2-270	20015	2020-03-11	2021-03-10
DC Power Supply	BACL	B12001-12	90023	2020-03-16	2021-03-15

## 1.4 Drive Level

Samples are driven with a constant direct current (DC) during maintenance test, photometric and electrical measurement. The current value was regulated to within  $\pm 3\%$  of the specified value of the manufacturer during maintenance test, and was within  $\pm 0.5\%$  during photometric and electrical measurement test.

## 1.5 Ambient Conditions for Maintenance Test

For lumen maintenance test, samples within one data set, were installed on cooling boards in thermal chambers with minimal ambient airflow. The case temperature and ambient temperature was monitored by thermocouples which one was soldered to the coldest DUTs' case ( $TMP_{LED}$ ) location, while the other is mounted at a distance of 5 mm above the TMP location.

During life testing,  $TMP_{LED}$  of the coldest LEDs were maintained at a temperature that was greater than or equal to  $2^{\circ}C$  below the corresponding nominal case temperature. Surrounding air was maintained at a temperature that was greater than or equal to  $5^{\circ}C$  below the corresponding nominal case temperature. Thermocouples were shielded from direct DUT optical radiation and comply with ASTM E230 Table 1 "Special Limits".

Samples were connected to DC power supply in series circuits with a constant current. The forward current was regulated to within  $\pm 3\%$  of the specified value of the manufacturer.

The relative humidity within chamber was kept less than 65% during test.

For photometry measurement, the ambient temperature during test was set to  $25^{\circ}C \pm 2^{\circ}C$ , RH <65%.

## 1.6 Photometric Measurement Method and Uncertainty

Integrating sphere and spectroradiometer is used to measure luminous flux and chromaticity coordinate  $u'v'$ .  $2\pi$  measurement was used and sample was driven by DC power supply. The forward current was regulated to within  $\pm 0.5\%$  of the nominal value. The test system was calibrated by halogen reference lamp. The ambient temperature during test was set to  $25^{\circ}C \pm 2^{\circ}C$ , RH <65%. The temperature measurement point was located in the sphere and the temperature was detected by a temperature probe.

The uncertainty of the light output measurements is  $U=1.59\%$  ( $K=2$ ), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is  $U=21K$  ( $K=2$ ), at the 95% confidence level.

The uncertainty of the temperature is  $U=0.8671^{\circ}C$  ( $K=2$ ), at the 95% confidence level.

## 1.7 Statement of Traceability

Bay Area Compliance Laboratories Corp. (Dongguan) attested that all calibration has been performed using suitable standards traceable to National Primary Standards and International System of Units (SI).

## 1.8 Sample Set

### Data Set 1: 55°C, 20mA

Part Number: P28351-W27SK2K3FR4R7-LX00  
Number of Units: 25  
Case Temperature: >53°C  
Ambient Temperature: >50°C  
Life Test Drive Current: 20mA  
Measurement Current: 20mA

### Data Set 2: 85°C, 20mA

Part Number: P28351-W27SK2K3FR4R7-LX00  
Number of Units: 25  
Case Temperature: >83°C  
Ambient Temperature: >80°C  
Life Test Drive Current: 20mA  
Measurement Current: 20mA

### Data Set 3: 105°C, 20mA

Part Number: P28351-W27SK2K3FR4R7-LX00  
Number of Units: 25  
Case Temperature: >103°C  
Ambient Temperature: >100°C  
Life Test Drive Current: 20mA  
Measurement Current: 20mA

## 2 - Summary of Test Result

Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	$\alpha$	$\beta$	Reported TM-21 L <sub>70</sub> Lifetime	Reported TM-21 L <sub>90</sub> Lifetime
1	25	0	1000hrs	9000hrs	2.669E-06	1.005	>54000 hours	41000 hours
2	25	0	1000hrs	9000hrs	3.074E-06	1.004	>54000 hours	36000 hours
3	25	0	1000hrs	9000hrs	3.747E-06	1.004	>54000 hours	29000 hours

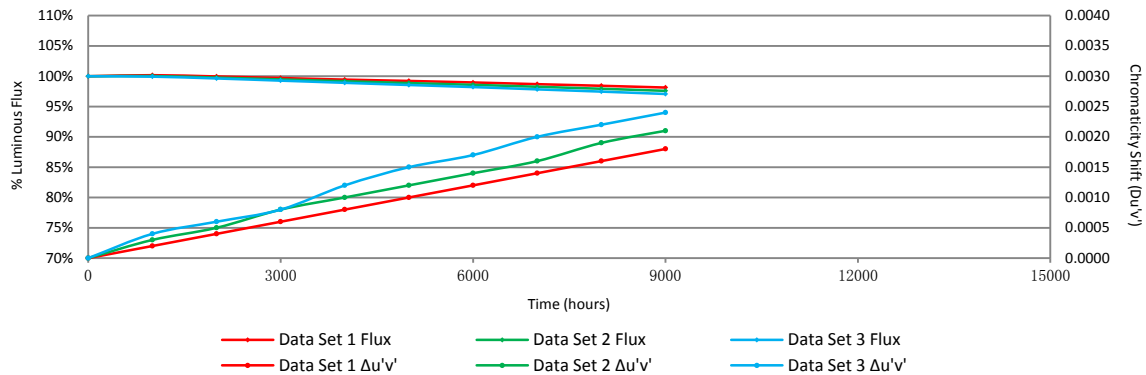
Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	100.17%	99.96%	99.70%	99.44%	99.22%	98.97%	98.69%	98.42%	98.13%
2	100.03%	99.77%	99.47%	99.17%	98.87%	98.58%	98.26%	97.93%	97.68%
3	99.93%	99.63%	99.27%	98.91%	98.55%	98.21%	97.83%	97.46%	97.07%

Average Chromaticity Shift

Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	0.0002	0.0004	0.0006	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018
2	0.0003	0.0005	0.0008	0.0010	0.0012	0.0014	0.0016	0.0019	0.0021
3	0.0004	0.0006	0.0008	0.0012	0.0015	0.0017	0.0020	0.0022	0.0024

Average Lumen Maintenance and Chromaticity Shift VS. Time



### 3 - Test Data

#### 3.1 Data Set 1, 55°C, 20mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	218.6	100.27	100.05	99.82	99.54	99.45	99.27	98.95	98.63	98.35
2	220.1	100.05	99.82	99.64	99.59	99.41	99.00	98.86	98.64	98.27
3	217.1	100.05	99.77	99.45	99.17	98.94	98.66	98.39	98.07	97.74
4	220.5	100.32	100.05	99.68	99.41	99.09	98.78	98.50	98.32	97.96
5	220.7	100.18	100.05	99.77	99.50	99.18	98.91	98.78	98.46	98.32
6	217.8	100.28	100.05	99.91	99.63	99.49	99.22	98.94	98.62	98.30
7	217.1	100.18	99.91	99.59	99.31	99.22	99.03	98.76	98.48	98.25
8	219.4	100.09	99.82	99.64	99.32	99.04	98.72	98.31	98.13	97.81
9	219.4	100.14	99.86	99.54	99.41	99.13	98.95	98.59	98.31	98.13
10	219.3	100.09	100.00	99.73	99.32	99.00	98.95	98.68	98.40	98.27
11	219.2	100.14	100.00	99.86	99.54	99.45	99.13	98.91	98.68	98.36
12	221.1	100.14	99.77	99.55	99.37	99.05	98.69	98.46	98.28	98.15
13	217.9	100.09	99.86	99.54	99.27	98.99	98.94	98.81	98.53	98.16
14	219.5	100.18	100.00	99.73	99.50	99.27	98.95	98.68	98.50	98.22
15	219.7	100.09	100.05	99.77	99.41	99.18	98.95	98.63	98.27	98.04
16	217.5	100.18	100.00	99.77	99.54	99.45	99.03	98.76	98.44	98.07
17	218.8	100.14	100.00	99.82	99.45	99.09	98.81	98.40	98.08	97.81
18	218.1	100.28	99.95	99.68	99.50	99.22	99.04	98.90	98.62	98.30
19	217.8	100.23	100.00	99.72	99.36	99.17	98.85	98.48	98.35	98.07
20	217.5	100.18	99.95	99.68	99.49	99.36	99.13	98.76	98.57	98.30
21	218.5	100.18	100.05	99.86	99.68	99.36	99.27	98.86	98.49	98.17
22	219.7	100.32	100.09	99.82	99.45	99.14	98.86	98.50	98.32	98.04
23	215.7	100.19	100.00	99.86	99.81	99.68	99.44	99.17	98.79	98.42
24	217.3	100.05	99.86	99.49	99.22	99.13	98.71	98.53	98.25	97.93
25	218.3	100.18	100.00	99.68	99.31	99.04	98.90	98.63	98.21	97.80
Avg.	218.7	100.17	99.96	99.70	99.44	99.22	98.97	98.69	98.42	98.13
Med.	218.6	100.18	100.00	99.72	99.45	99.18	98.95	98.68	98.44	98.16
st dev	1.3	0.08	0.09	0.13	0.15	0.19	0.20	0.21	0.19	0.20
Min.	215.7	100.05	99.77	99.45	99.17	98.94	98.66	98.31	98.07	97.74
Max.	221.1	100.32	100.09	99.91	99.81	99.68	99.44	99.17	98.79	98.42

**3.2 Data Set 1, 55°C, 20mA (Forward Voltage)**

No.	Forward Voltage (V)									
	Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	72.16	72.11	72.14	72.13	72.30	72.42	72.18	72.17	72.18	72.21
2	72.32	72.29	72.30	72.28	72.47	72.60	72.33	72.34	72.34	72.38
3	72.21	72.20	72.22	72.23	72.37	72.51	72.36	72.23	72.28	72.28
4	72.29	72.30	72.30	72.27	72.54	72.59	72.32	72.31	72.35	72.36
5	72.19	72.18	72.20	72.14	72.35	72.45	72.22	72.19	72.24	72.24
6	72.35	72.43	72.36	72.35	72.51	72.66	72.40	72.37	72.42	72.41
7	72.15	72.19	72.20	72.15	72.31	72.41	72.17	72.16	72.19	72.21
8	72.16	72.25	72.31	72.18	72.33	72.46	72.20	72.19	72.23	72.26
9	72.26	72.33	72.31	72.22	72.45	72.53	72.28	72.27	72.33	72.36
10	72.22	72.32	72.31	72.21	72.43	72.52	72.26	72.25	72.29	72.32
11	72.17	72.25	72.34	72.18	73.00	72.46	72.23	72.19	72.26	72.29
12	72.28	72.36	73.18	72.28	72.44	72.57	72.32	72.32	72.34	72.37
13	72.25	72.33	73.05	72.26	72.41	72.54	72.31	72.29	72.31	72.36
14	72.10	72.19	72.29	72.13	72.43	72.36	72.17	72.14	72.19	72.21
15	72.21	72.31	72.68	72.26	72.39	72.55	72.27	72.26	72.31	72.34
16	72.12	72.23	72.18	72.21	72.33	72.44	72.19	72.16	72.23	72.25
17	72.35	72.43	72.42	72.41	72.54	72.66	72.43	72.39	72.45	72.49
18	72.31	72.38	72.74	72.36	72.46	72.58	72.38	72.36	72.37	72.43
19	72.20	72.33	72.68	72.26	72.37	72.45	72.32	72.26	72.30	72.32
20	72.26	72.36	72.70	72.28	72.42	72.52	72.32	72.30	72.31	72.34
21	72.15	72.28	72.97	72.16	72.29	72.41	72.21	72.19	72.27	72.26
22	72.32	72.41	72.30	72.36	72.53	72.60	72.40	72.36	72.42	72.44
23	72.37	72.46	72.79	72.39	72.54	72.65	72.41	72.42	72.48	72.48
24	72.36	72.42	72.38	72.34	72.52	72.63	72.39	72.40	72.47	72.42
25	72.07	72.15	72.08	72.05	72.21	72.34	72.11	72.09	72.16	72.13
Avg.	72.23	72.30	72.46	72.24	72.44	72.52	72.29	72.26	72.31	72.33
Med.	72.22	72.31	72.31	72.26	72.43	72.52	72.31	72.26	72.31	72.34
st dev	0.09	0.10	0.30	0.09	0.15	0.09	0.09	0.09	0.09	0.09
Min.	72.07	72.11	72.08	72.05	72.21	72.34	72.11	72.09	72.16	72.13
Max.	72.37	72.46	73.18	72.41	73.00	72.66	72.43	72.42	72.48	72.49



**3.3 Data Set 1, 55°C, 20mA (Chromaticity Shift)**

No.	u'	v'	CCT(K)	Chromaticity Shift ( $\Delta u'v'$ )								
				1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	0.2586	0.5239	2798	0.0001	0.0003	0.0005	0.0007	0.0009	0.0012	0.0013	0.0014	0.0016
2	0.2603	0.5269	2748	0.0002	0.0004	0.0005	0.0006	0.0009	0.0010	0.0014	0.0015	0.0017
3	0.2609	0.5264	2738	0.0002	0.0004	0.0006	0.0006	0.0008	0.0009	0.0012	0.0014	0.0017
4	0.2595	0.5274	2762	0.0002	0.0004	0.0005	0.0006	0.0009	0.0010	0.0011	0.0014	0.0016
5	0.2580	0.5265	2799	0.0001	0.0004	0.0006	0.0008	0.0009	0.0010	0.0011	0.0012	0.0015
6	0.2615	0.5266	2724	0.0001	0.0003	0.0004	0.0007	0.0010	0.0011	0.0013	0.0015	0.0016
7	0.2610	0.5252	2741	0.0002	0.0005	0.0008	0.0009	0.0012	0.0013	0.0014	0.0016	0.0019
8	0.2596	0.5262	2766	0.0003	0.0004	0.0007	0.0009	0.0011	0.0014	0.0015	0.0016	0.0019
9	0.2613	0.5276	2723	0.0001	0.0003	0.0006	0.0008	0.0011	0.0013	0.0016	0.0019	0.0021
10	0.2601	0.5254	2758	0.0001	0.0002	0.0003	0.0006	0.0010	0.0013	0.0016	0.0018	0.0021
11	0.2590	0.5258	2781	0.0003	0.0004	0.0005	0.0006	0.0008	0.0011	0.0014	0.0017	0.0020
12	0.2587	0.5265	2785	0.0003	0.0004	0.0006	0.0008	0.0009	0.0012	0.0016	0.0019	0.0021
13	0.2599	0.5255	2763	0.0002	0.0003	0.0005	0.0007	0.0009	0.0010	0.0013	0.0016	0.0018
14	0.2590	0.5264	2777	0.0002	0.0004	0.0006	0.0007	0.0010	0.0011	0.0014	0.0016	0.0019
15	0.2581	0.5255	2803	0.0002	0.0004	0.0006	0.0008	0.0009	0.0012	0.0014	0.0015	0.0018
16	0.2607	0.5250	2748	0.0003	0.0004	0.0006	0.0008	0.0010	0.0012	0.0014	0.0016	0.0019
17	0.2618	0.5276	2714	0.0002	0.0004	0.0006	0.0007	0.0008	0.0009	0.0011	0.0013	0.0016
18	0.2602	0.5259	2754	0.0003	0.0005	0.0006	0.0007	0.0009	0.0010	0.0012	0.0015	0.0017
19	0.2606	0.5237	2756	0.0004	0.0006	0.0008	0.0009	0.0011	0.0011	0.0013	0.0014	0.0015
20	0.2605	0.5256	2749	0.0003	0.0004	0.0007	0.0010	0.0011	0.0012	0.0013	0.0014	0.0016
21	0.2587	0.5262	2786	0.0001	0.0004	0.0006	0.0009	0.0011	0.0012	0.0013	0.0014	0.0016
22	0.2598	0.5255	2765	0.0001	0.0004	0.0006	0.0009	0.0012	0.0015	0.0016	0.0017	0.0018
23	0.2584	0.5227	2808	0.0001	0.0003	0.0004	0.0008	0.0009	0.0013	0.0016	0.0018	0.0019
24	0.2612	0.5269	2729	0.0002	0.0004	0.0005	0.0008	0.0011	0.0013	0.0017	0.0019	0.0022
25	0.2615	0.5268	2724	0.0003	0.0004	0.0006	0.0009	0.0011	0.0014	0.0018	0.0021	0.0024
Avg.	0.2600	0.5259	2760	0.0002	0.0004	0.0006	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018
Med.	0.2601	0.5262	2758	0.0002	0.0004	0.0006	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018
st dev	0.0012	0.0012	27	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002
Min.	0.2580	0.5227	2714	0.0001	0.0002	0.0003	0.0006	0.0008	0.0009	0.0011	0.0012	0.0015
Max.	0.2618	0.5276	2808	0.0004	0.0006	0.0008	0.0010	0.0012	0.0015	0.0018	0.0021	0.0024

### 3.4 Data Set 2, 85°C, 20mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)								
	Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
26	218.5	100.18	100.05	99.73	99.36	99.27	98.95	98.76	98.58	98.44
27	217.8	100.05	99.59	99.36	99.17	98.71	98.35	98.07	97.80	97.52
28	216.9	99.91	99.68	99.40	99.03	98.62	98.39	97.88	97.56	97.37
29	217.3	100.05	99.86	99.54	99.26	98.90	98.57	98.11	97.75	97.47
30	218.4	99.91	99.59	99.27	99.08	98.95	98.63	98.26	98.03	97.85
31	220.7	99.95	99.77	99.50	99.09	98.82	98.50	98.23	97.83	97.51
32	217.9	99.91	99.63	99.27	99.08	98.99	98.72	98.44	97.98	97.84
33	218.9	100.05	99.82	99.41	99.04	98.58	98.36	98.13	97.72	97.40
34	216.9	100.09	99.82	99.49	99.22	98.94	98.71	98.29	98.11	97.88
35	216.8	99.91	99.82	99.49	99.08	98.80	98.39	98.11	97.74	97.56
36	218.8	99.95	99.68	99.31	99.09	98.67	98.45	98.17	97.81	97.58
37	218.9	100.09	99.82	99.50	99.13	99.09	98.90	98.49	98.17	97.76
38	219.8	100.14	100.00	99.73	99.41	99.18	98.86	98.54	98.32	98.00
39	217.2	99.95	99.49	99.26	99.08	98.76	98.48	98.07	97.79	97.47
40	217.4	100.05	99.72	99.26	99.13	98.76	98.48	98.25	98.02	97.75
41	218.6	100.05	99.86	99.54	99.09	98.76	98.63	98.44	98.12	97.99
42	218.3	99.95	99.63	99.36	99.08	98.85	98.58	98.17	97.80	97.66
43	219.8	100.09	99.64	99.32	99.09	98.68	98.27	98.09	97.82	97.45
44	215.9	100.19	100.00	99.77	99.26	99.07	98.75	98.56	98.10	97.87
45	217.2	100.05	99.95	99.63	99.40	99.13	98.85	98.43	98.02	97.65
46	217.2	99.91	99.63	99.31	98.99	98.53	98.16	97.88	97.47	97.10
47	219.7	100.09	99.73	99.41	99.14	98.82	98.63	98.32	98.04	97.91
48	218.5	100.14	99.95	99.77	99.50	99.08	98.72	98.44	98.08	97.85
49	218.5	100.05	99.77	99.54	99.22	98.76	98.44	98.03	97.67	97.44
50	218.1	100.09	99.77	99.50	99.13	98.99	98.67	98.26	97.94	97.80
Avg.	218.2	100.03	99.77	99.47	99.17	98.87	98.58	98.26	97.93	97.68
Med.	218.3	100.05	99.77	99.49	99.13	98.82	98.58	98.25	97.94	97.66
st dev	1.1	0.09	0.15	0.16	0.13	0.20	0.20	0.22	0.24	0.27
Min.	215.9	99.91	99.49	99.26	98.99	98.53	98.16	97.88	97.47	97.10
Max.	220.7	100.19	100.05	99.77	99.50	99.27	98.95	98.76	98.58	98.44

**3.5 Data Set 2, 85°C, 20mA (Forward Voltage)**

No.	Forward Voltage (V)									
	Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
26	72.21	72.29	72.79	72.24	72.39	72.50	72.28	72.26	72.29	72.34
27	72.18	72.23	72.24	72.19	72.31	72.44	72.21	72.22	72.26	72.27
28	72.09	72.20	72.20	72.13	72.29	72.40	72.19	72.17	72.25	72.22
29	72.19	72.30	72.27	72.20	72.40	72.47	72.27	72.26	72.30	72.31
30	72.24	73.56	72.53	72.22	72.38	72.50	72.28	72.25	72.33	72.32
31	72.27	72.36	72.39	72.28	72.49	72.58	72.37	72.39	72.41	72.40
32	72.26	72.32	73.05	72.26	72.41	72.55	72.28	72.30	72.33	72.35
33	72.28	72.34	72.84	72.32	72.48	72.59	72.36	72.36	72.37	72.41
34	72.16	72.22	72.54	72.16	72.33	72.42	72.18	72.19	72.24	72.26
35	72.03	72.06	72.48	72.02	72.20	72.30	72.07	72.08	72.13	72.13
36	72.27	72.30	72.84	72.26	72.47	72.57	72.33	72.31	72.37	72.38
37	72.32	72.39	72.41	72.32	72.51	72.62	72.37	72.40	72.40	72.42
38	72.21	72.25	72.29	72.22	72.41	72.50	72.25	72.28	72.28	72.33
39	72.26	72.30	72.40	72.29	72.50	72.58	72.34	72.33	72.33	72.39
40	72.27	72.32	72.98	72.27	72.47	72.57	72.33	72.38	72.36	72.40
41	72.16	72.19	72.23	72.18	72.38	72.47	72.25	72.24	72.21	72.24
42	72.18	72.18	72.27	72.20	72.38	72.48	72.26	72.26	72.26	72.28
43	72.18	72.21	72.51	72.23	72.41	72.46	72.25	72.25	72.24	72.29
44	72.05	72.08	72.15	72.10	72.26	72.36	72.13	72.15	72.19	72.16
45	72.25	72.24	72.32	72.26	72.42	72.53	72.31	72.33	72.35	72.34
46	72.23	72.26	72.80	72.26	72.41	72.51	72.33	72.31	72.32	72.32
47	72.16	72.16	72.61	72.15	72.35	72.41	72.25	72.21	72.24	72.27
48	72.20	72.19	72.37	72.21	79.93	72.46	72.32	72.25	72.29	72.33
49	72.29	72.29	72.95	72.31	72.49	72.59	72.38	72.35	72.40	72.43
50	72.24	72.24	73.03	72.25	72.44	72.50	72.33	72.28	72.32	72.33
Avg.	72.21	72.30	72.54	72.22	72.70	72.49	72.28	72.27	72.30	72.32
Med.	72.21	72.25	72.48	72.23	72.41	72.50	72.28	72.26	72.30	72.33
st dev	0.07	0.27	0.29	0.07	1.51	0.08	0.08	0.08	0.07	0.08
Min.	72.03	72.06	72.15	72.02	72.20	72.30	72.07	72.08	72.13	72.13
Max.	72.32	73.56	73.05	72.32	79.93	72.62	72.38	72.40	72.41	72.43

**3.6 Data Set 2, 85°C, 20mA (Chromaticity Shift)**

No.	u'	v'	CCT(K)	Chromaticity Shift ( $\Delta u'v'$ )								
	Ohr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
26	0.2585	0.5242	2800	0.0003	0.0004	0.0006	0.0008	0.0010	0.0014	0.0017	0.0020	0.0022
27	0.2597	0.5257	2767	0.0004	0.0006	0.0008	0.0009	0.0010	0.0013	0.0017	0.0020	0.0022
28	0.2597	0.5256	2766	0.0005	0.0007	0.0008	0.0009	0.0011	0.0012	0.0014	0.0017	0.0020
29	0.2590	0.5264	2779	0.0003	0.0007	0.0010	0.0011	0.0013	0.0014	0.0015	0.0016	0.0018
30	0.2591	0.5261	2777	0.0002	0.0005	0.0007	0.0009	0.0013	0.0013	0.0014	0.0016	0.0018
31	0.2577	0.5238	2820	0.0002	0.0004	0.0007	0.0010	0.0012	0.0014	0.0016	0.0017	0.0018
32	0.2597	0.5254	2768	0.0002	0.0004	0.0006	0.0009	0.0011	0.0013	0.0016	0.0018	0.0019
33	0.2576	0.5252	2813	0.0002	0.0004	0.0006	0.0009	0.0012	0.0014	0.0016	0.0019	0.0021
34	0.2597	0.5233	2777	0.0004	0.0007	0.0009	0.0011	0.0012	0.0016	0.0017	0.0019	0.0021
35	0.2584	0.5257	2795	0.0003	0.0006	0.0009	0.0011	0.0012	0.0015	0.0018	0.0020	0.0022
36	0.2593	0.5272	2769	0.0004	0.0005	0.0008	0.0009	0.0014	0.0016	0.0019	0.0021	0.0023
37	0.2592	0.5264	2774	0.0003	0.0006	0.0009	0.0012	0.0013	0.0015	0.0018	0.0021	0.0023
38	0.2600	0.5271	2753	0.0003	0.0006	0.0009	0.0010	0.0013	0.0015	0.0018	0.0020	0.0022
39	0.2598	0.5254	2766	0.0004	0.0006	0.0008	0.0010	0.0013	0.0016	0.0018	0.0019	0.0021
40	0.2595	0.5244	2777	0.0004	0.0005	0.0007	0.0009	0.0012	0.0015	0.0016	0.0019	0.0021
41	0.2600	0.5265	2756	0.0002	0.0005	0.0007	0.0010	0.0012	0.0015	0.0017	0.0020	0.0021
42	0.2607	0.5262	2743	0.0004	0.0005	0.0007	0.0009	0.0013	0.0016	0.0018	0.0021	0.0022
43	0.2588	0.5266	2781	0.0003	0.0006	0.0007	0.0008	0.0011	0.0014	0.0017	0.0020	0.0022
44	0.2614	0.5268	2726	0.0002	0.0006	0.0008	0.0009	0.0011	0.0014	0.0016	0.0019	0.0022
45	0.2610	0.5268	2733	0.0003	0.0005	0.0008	0.0009	0.0011	0.0013	0.0015	0.0019	0.0022
46	0.2590	0.5245	2787	0.0003	0.0005	0.0007	0.0009	0.0011	0.0014	0.0014	0.0016	0.0020
47	0.2580	0.5266	2799	0.0004	0.0006	0.0009	0.0010	0.0011	0.0013	0.0015	0.0017	0.0019
48	0.2576	0.5255	2813	0.0003	0.0005	0.0008	0.0012	0.0014	0.0015	0.0016	0.0018	0.0020
49	0.2586	0.5256	2791	0.0003	0.0004	0.0005	0.0006	0.0011	0.0013	0.0016	0.0017	0.0018
50	0.2604	0.5262	2748	0.0002	0.0003	0.0004	0.0007	0.0010	0.0012	0.0015	0.0016	0.0018
Avg.	0.2593	0.5257	2775	0.0003	0.0005	0.0008	0.0010	0.0012	0.0014	0.0016	0.0019	0.0021
Med.	0.2593	0.5257	2777	0.0003	0.0005	0.0008	0.0009	0.0012	0.0014	0.0016	0.0019	0.0021
st dev	0.0010	0.0010	24	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002
Min.	0.2576	0.5233	2726	0.0002	0.0003	0.0004	0.0006	0.0010	0.0012	0.0014	0.0016	0.0018
Max.	0.2614	0.5272	2820	0.0005	0.0007	0.0010	0.0012	0.0014	0.0016	0.0019	0.0021	0.0023

**3.7 Data Set 3, 105°C, 20mA (Lumen Maintenance)**

No.	Φ(lm)	Lumen Maintenance (%)								
	Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
51	218.6	99.91	99.59	99.36	98.95	98.63	98.22	98.03	97.58	97.21
52	220.2	99.82	99.41	98.96	98.68	98.32	98.14	97.82	97.59	97.23
53	218.1	100.05	99.82	99.54	99.17	98.76	98.30	98.03	97.62	97.16
54	218.5	99.86	99.77	99.31	98.86	98.58	98.35	97.85	97.35	96.89
55	218.7	99.82	99.36	99.04	98.72	98.35	97.94	97.67	97.35	97.12
56	219.2	99.95	99.73	99.32	98.81	98.59	98.22	97.81	97.49	97.13
57	217.8	99.95	99.59	99.27	98.85	98.39	98.12	97.75	97.25	96.88
58	219.3	100.09	99.64	99.41	99.00	98.59	98.13	97.86	97.40	97.04
59	218.1	100.05	99.86	99.36	99.08	98.67	98.26	97.85	97.48	97.11
60	217.4	99.91	99.54	99.22	98.80	98.53	98.25	97.84	97.42	96.96
61	215.2	99.95	99.67	99.26	99.02	98.75	98.37	98.09	97.68	97.26
62	217.3	99.86	99.36	98.99	98.53	98.02	97.70	97.24	96.78	96.36
63	216.9	99.82	99.54	99.22	98.89	98.48	98.06	97.65	97.19	96.77
64	219.0	100.05	99.59	99.22	98.86	98.31	97.90	97.40	96.94	96.58
65	217.2	99.82	99.72	99.31	98.94	98.90	98.62	98.16	97.88	97.42
66	216.6	99.91	99.72	99.40	98.89	98.52	98.06	97.60	97.18	96.72
67	218.2	99.91	99.50	99.22	98.95	98.76	98.44	98.08	97.80	97.34
68	217.9	100.09	99.68	99.36	98.99	98.49	98.39	97.89	97.52	97.20
69	216.6	100.09	99.77	99.35	98.98	98.75	98.38	98.25	98.01	97.74
70	215.8	99.86	99.77	99.44	99.07	98.84	98.33	97.91	97.68	97.31
71	218.0	100.05	99.86	99.40	99.08	98.58	98.49	98.07	97.75	97.29
72	217.3	99.82	99.49	99.13	98.94	98.57	98.34	98.11	97.65	97.28
73	218.9	99.95	99.50	99.18	98.86	98.36	97.85	97.44	97.21	96.80
74	217.7	99.82	99.49	99.08	98.90	98.53	98.12	97.57	97.29	96.83
75	217.1	99.86	99.68	99.31	98.85	98.53	98.16	97.84	97.42	97.24
Avg.	217.8	99.93	99.63	99.27	98.91	98.55	98.21	97.83	97.46	97.07
Med.	217.9	99.91	99.64	99.31	98.90	98.57	98.22	97.85	97.48	97.13
st dev	1.1	0.10	0.15	0.14	0.14	0.19	0.21	0.25	0.28	0.30
Min.	215.2	99.82	99.36	98.96	98.53	98.02	97.70	97.24	96.78	96.36
Max.	220.2	100.09	99.86	99.54	99.17	98.90	98.62	98.25	98.01	97.74

**3.8 Data Set 3, 105°C, 20mA (Forward Voltage)**

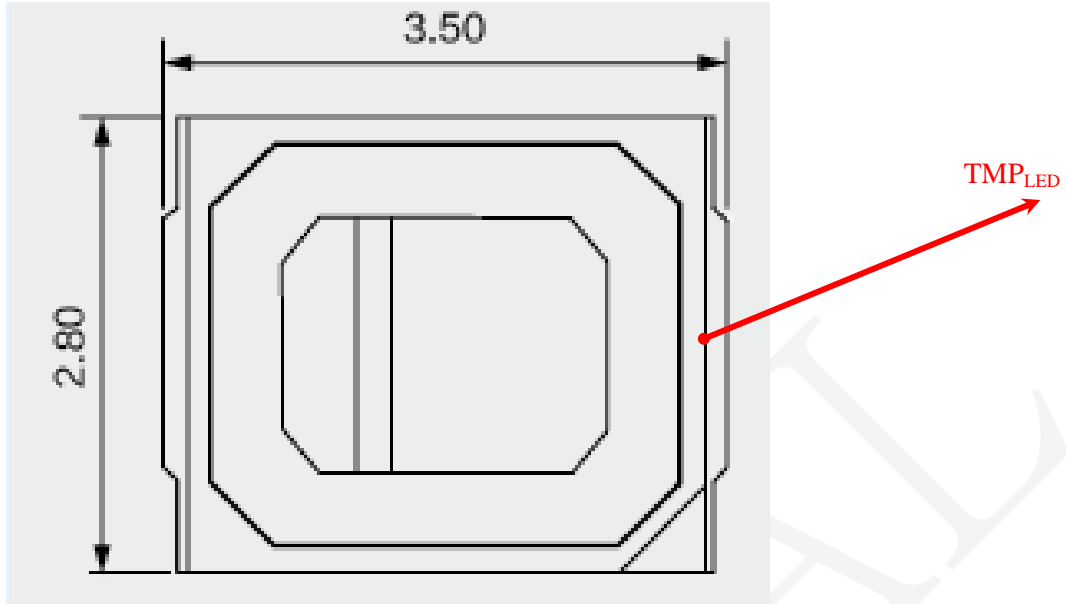
No.	Forward Voltage (V)									
	Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
51	72.31	72.31	72.37	72.39	72.51	72.60	72.42	72.39	72.40	72.44
52	72.22	72.22	72.31	72.32	72.45	72.54	72.33	72.28	72.32	72.35
53	72.15	72.17	72.23	72.25	72.40	72.46	72.26	72.21	72.22	72.30
54	72.32	72.28	72.38	72.38	72.49	72.58	72.37	72.33	72.33	72.41
55	72.31	72.26	72.41	72.37	72.49	72.56	72.36	72.33	72.35	72.39
56	72.10	72.02	72.16	72.17	72.39	72.35	72.17	72.13	72.19	72.18
57	72.13	72.09	72.18	72.16	72.28	72.38	72.18	72.16	72.19	72.19
58	72.28	72.24	72.36	72.36	72.51	72.55	72.65	72.32	72.36	72.40
59	72.28	72.30	72.51	72.31	72.63	72.54	72.40	72.33	72.34	72.39
60	72.27	72.24	72.32	72.28	72.47	72.49	72.35	72.29	72.31	72.36
61	72.15	72.17	72.22	72.24	72.34	72.43	72.23	72.25	72.25	72.28
62	72.22	72.21	72.28	72.28	72.40	72.47	72.30	72.29	72.32	72.34
63	72.21	72.18	72.24	72.25	72.40	72.44	72.27	72.27	72.29	72.30
64	72.16	72.11	72.21	72.21	72.35	72.39	72.23	72.21	72.23	72.26
65	72.18	72.16	72.23	72.21	72.38	72.44	72.25	72.23	72.26	72.28
66	72.23	72.23	72.30	72.26	72.42	72.49	72.31	72.28	72.36	72.34
67	72.30	72.24	72.34	72.28	72.63	72.53	72.38	72.32	72.36	72.40
68	72.33	72.29	72.38	72.33	72.50	72.57	72.43	72.36	72.39	72.41
69	72.23	72.20	72.27	72.26	72.43	72.48	72.31	72.27	72.31	72.32
70	72.18	72.13	72.17	72.18	72.41	72.42	72.26	72.18	72.23	72.22
71	72.25	72.24	72.31	72.28	72.41	72.51	72.36	72.28	72.36	72.32
72	72.15	72.16	72.19	72.17	72.31	72.40	72.23	72.16	72.21	72.25
73	72.27	72.28	72.31	72.28	72.81	72.53	72.36	72.29	72.33	72.37
74	72.38	72.35	72.41	72.35	72.54	72.63	72.45	72.39	72.42	72.48
75	72.29	72.30	72.36	72.30	72.48	72.55	72.40	72.32	72.36	72.41
Avg.	72.24	72.22	72.30	72.27	72.46	72.49	72.33	72.27	72.31	72.34
Med.	72.23	72.23	72.31	72.28	72.43	72.49	72.33	72.28	72.32	72.34
st dev	0.07	0.08	0.09	0.07	0.11	0.07	0.10	0.07	0.07	0.08
Min.	72.10	72.02	72.16	72.16	72.28	72.35	72.17	72.13	72.19	72.18
Max.	72.38	72.35	72.51	72.39	72.81	72.63	72.65	72.39	72.42	72.48

**3.9 Data Set 3, 105°C, 20mA (Chromaticity Shift)**

No.	u'	v'	CCT(K)	Chromaticity Shift ( $\Delta u'v'$ )								
	Ohr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
51	0.2597	0.5254	2767	0.0002	0.0003	0.0004	0.0006	0.0009	0.0011	0.0014	0.0015	0.0017
52	0.2594	0.5279	2763	0.0004	0.0004	0.0006	0.0006	0.0010	0.0012	0.0015	0.0017	0.0018
53	0.2596	0.5270	2763	0.0003	0.0005	0.0006	0.0008	0.0010	0.0012	0.0015	0.0017	0.0018
54	0.2591	0.5258	2779	0.0004	0.0005	0.0008	0.0009	0.0010	0.0012	0.0013	0.0016	0.0017
55	0.2597	0.5260	2764	0.0004	0.0005	0.0007	0.0011	0.0013	0.0014	0.0015	0.0016	0.0018
56	0.2594	0.5258	2772	0.0003	0.0006	0.0008	0.0012	0.0013	0.0015	0.0016	0.0018	0.0019
57	0.2603	0.5251	2756	0.0004	0.0007	0.0008	0.0014	0.0016	0.0018	0.0019	0.0021	0.0023
58	0.2587	0.5253	2790	0.0004	0.0006	0.0008	0.0013	0.0015	0.0017	0.0018	0.0020	0.0023
59	0.2600	0.5249	2762	0.0003	0.0006	0.0008	0.0013	0.0016	0.0019	0.0020	0.0021	0.0023
60	0.2610	0.5266	2734	0.0004	0.0006	0.0008	0.0013	0.0016	0.0019	0.0021	0.0024	0.0027
61	0.2593	0.5248	2778	0.0004	0.0007	0.0008	0.0016	0.0017	0.0022	0.0023	0.0025	0.0028
62	0.2608	0.5279	2733	0.0004	0.0006	0.0008	0.0014	0.0016	0.0019	0.0022	0.0025	0.0027
63	0.2615	0.5263	2725	0.0004	0.0005	0.0008	0.0014	0.0016	0.0019	0.0020	0.0024	0.0026
64	0.2580	0.5230	2816	0.0005	0.0007	0.0009	0.0014	0.0016	0.0018	0.0021	0.0024	0.0027
65	0.2596	0.5255	2768	0.0004	0.0007	0.0009	0.0013	0.0015	0.0018	0.0021	0.0022	0.0025
66	0.2598	0.5261	2763	0.0005	0.0008	0.0010	0.0013	0.0017	0.0018	0.0021	0.0023	0.0024
67	0.2581	0.5262	2799	0.0004	0.0006	0.0009	0.0012	0.0016	0.0017	0.0019	0.0022	0.0023
68	0.2598	0.5241	2772	0.0005	0.0008	0.0009	0.0016	0.0018	0.0021	0.0022	0.0025	0.0026
69	0.2601	0.5236	2767	0.0004	0.0007	0.0009	0.0014	0.0017	0.0019	0.0020	0.0022	0.0024
70	0.2615	0.5244	2733	0.0004	0.0008	0.0010	0.0014	0.0016	0.0019	0.0022	0.0024	0.0026
71	0.2599	0.5266	2758	0.0003	0.0006	0.0008	0.0013	0.0016	0.0019	0.0021	0.0024	0.0026
72	0.2598	0.5253	2766	0.0004	0.0007	0.0010	0.0014	0.0016	0.0019	0.0021	0.0024	0.0025
73	0.2590	0.5260	2781	0.0005	0.0008	0.0011	0.0014	0.0017	0.0020	0.0024	0.0026	0.0027
74	0.2608	0.5254	2745	0.0004	0.0007	0.0011	0.0014	0.0016	0.0019	0.0022	0.0025	0.0026
75	0.2599	0.5234	2773	0.0004	0.0005	0.0009	0.0013	0.0017	0.0021	0.0023	0.0025	0.0027
Avg.	0.2598	0.5255	2765	0.0004	0.0006	0.0008	0.0012	0.0015	0.0017	0.0020	0.0022	0.0024
Med.	0.2598	0.5255	2766	0.0004	0.0006	0.0008	0.0013	0.0016	0.0019	0.0021	0.0023	0.0025
st dev	0.0009	0.0012	21	0.0001	0.0001	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0004
Min.	0.2580	0.5230	2725	0.0002	0.0003	0.0004	0.0006	0.0009	0.0011	0.0013	0.0015	0.0017
Max.	0.2615	0.5279	2816	0.0005	0.0008	0.0011	0.0016	0.0018	0.0022	0.0024	0.0026	0.0028

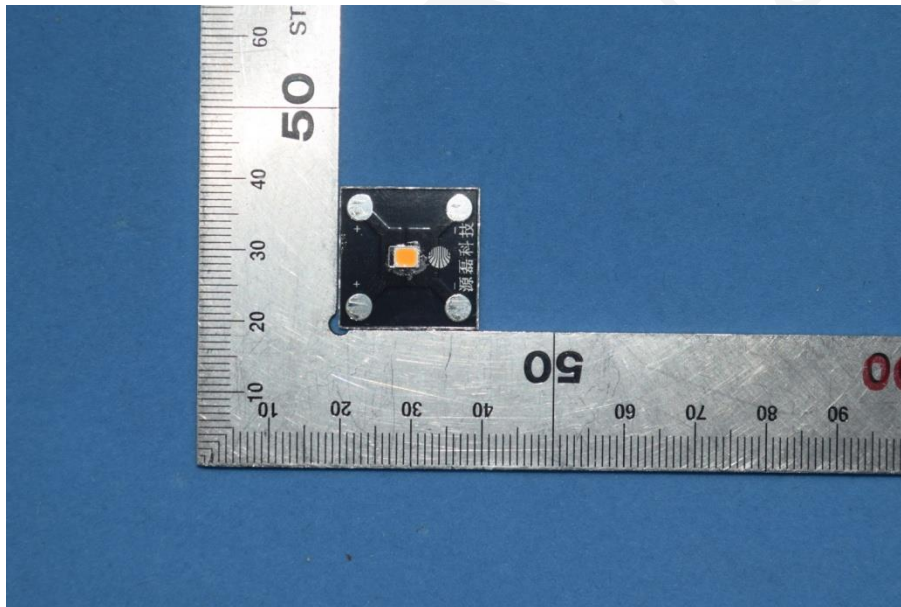
#### 4 - DUT Photo

##### 4.1 #Mechanical Dimensions



All dimensions are in millimeter

##### 4.2 DUT Photo





## Directions

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1. The information marked "superscript #" is provided by the applicant, the laboratory is not responsible for its authenticity and this information can affect the validity of the result in the test report.
2. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
3. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.
4. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.
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\*\*\*\*\*END OF REPORT\*\*\*\*\*